

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Promoting Investment in the 3550-3700 MHz)	GN Docket No. 17-258
Band)	

COMMENTS OF NOKIA

Nokia responds to the Notice of Proposed Rulemaking (“NPRM”) issued in the above-captioned proceeding asking for comment on proposed changes to the rules governing the 3550-3700 MHz band.¹

I. SUMMARY

Nokia believes that intensive use of the band by the carrier community will ensure a robust equipment ecosystem, creating economies of scale and driving down user device costs. For these reasons, Nokia supports the Commission’s proposals that will spur robust, sustained investment in the band.

To that end, Nokia supports increasing Priority Access License (PAL) terms to 10 years, with an expectation for renewal. Nokia also agrees that geographic license sizes should be increased to support broader deployments, while considering retaining a subset of smaller-scale licenses for micro-deployments in urban as well as rural areas. Further supporting smaller deployments, the Commission should implement its proposal to support robust secondary market transactions through disaggregation and partitioning. Nokia supports the Commission’s proposal that SAS Administrators not be required under the rules to disclose Citizen Broadband Radio Service Device (CBSD) registration information, and that all available PALs to be assigned to meet demand, regardless of number of bidders.

¹ *Promoting Investment in the 3550-3700 MHz Band*, GN Docket No. 17-258, FCC 17-134 (rel. Oct. 24, 2017) (“NPRM”).

Nokia concludes these Comments with a technical analysis of the current rules versus the two alternative proposals set forth in the NPRM for relaxing emissions limits to permit wider-channels in the band. Nokia's analysis demonstrates that the Commission should revise its rules consistent with the relaxed emissions limits proposed by Qualcomm, so long as the rule change does not result in slowing down Commission authorization to commence service in the 3.5 GHz band. The potential for increased interference to affect performance of users operating on adjacent channels as a result of the relaxation should also be studied. Moreover, it is Nokia's judgment that, because Qualcomm's request does not modify the -40 dBm/MHz additional protection level in Section 96.41(e)(2) of the rules (which protect users outside the 3550-3700 MHz band), the suggested changes would not have any negative impact to incumbents.

II. THE COMMISSION SHOULD INCREASE THE TERM FOR PALS, AS GREATER CERTAINTY WILL PROMOTE INVESTMENT

In the NPRM, the Commission proposes to increase the PAL license terms from three years to ten years, and to eliminate the requirement that PALs automatically terminate at the end of the license term.² Nokia supports the Commission's proposal derived from a proven track-record in other bands demonstrating the benefits to investment and deployment facilitated by greater certainty of longer license terms with renewal expectations.

As the Commission states in the NPRM, a ten-year license term with renewal expectation is "consistent with that adopted for other wireless services and will afford each licensee sufficient time to design and acquire the necessary equipment and devices and to deploy facilities across the license area."³ We agree. In Nokia's experience, it generally takes several quarters to standardize a new frequency band, another year to develop

² *Id.* ¶ 13.

³ *Id.*

infrastructure equipment and certify it, and over a year to deploy a network. As such, it is a barrier to investment if a PAL carries with it uncertainty of termination after only 3 years.

The small cell deployments envisioned for the 3.5 GHz band will add an even greater layer of complexity to roll-out. Small cell deployments involve a relatively large number of sites and can take advantage of a far wider range of locations for deployment (street lights, billboards, sides of buildings, etc.) than can macrocells. As such, in contrast to historic, initial roll-outs of new frequency bands that could leverage existing macrocell sites, deployments in the 3.5 GHz band will require new sites with new power and backhaul services that are not shared with equipment operating in earlier frequency bands. Add to that the bureaucratic barriers inherent in many state and local permitting processes, service providers face a daunting climb to reach wide-spread deployment of small cells in any band, let alone first deployment of 3.5 GHz band equipment in the United States.⁴

Along with longer terms, renewal expectation will also drive investment. Loss of access to the band could devastate a business plan built on the 3.5 GHz band if comparable General Authorized Access (GAA) spectrum is not available. Stepping down to the GAA tier *may* suffice if a PAL is lost as there is no guarantee of availability of GAA spectrum featuring the amount of bandwidth and quality of service required. Therefore, renewal expectation should be included for PALs in the 3.5 GHz band, as proposed in the NPRM.

III. THE COMMISSION SHOULD EXPLORE A HYBRID APPROACH TO PAL GEOGRAPHIC SCOPE AND ALSO ALLOW SECONDARY MARKET TRANSACTIONS

Nokia agrees that larger PAL geographic sizes are required to facilitate wide-scale deployment, but appreciates that the NPRM seeks comment on retaining small license sizes

⁴ See generally, *Accelerating Wireless Deployment by Removing Barriers to Infrastructure Investment*, Notice of Proposed Rulemaking and Notice of Inquiry, WT Docket No. 17-79 (rel. Apr. 21, 2017).

as well.⁵ For those seeking to provide service over a large geographic area, such larger geographic license scope could help spur deployment in the band, compared to managing thousands (or tens of thousands) of census tracts. Assuming each census block targets a population of approximately 4,000 people, serving regions with urban centers and populous suburbs would be especially burdensome. Nokia agrees with the NPRM's suggestion that Partial Economic Areas is a reasonable choice for large scale deployments.

Nokia also recognizes the potential for micro-deployments by operators, as well as government, enterprise and other types of users that desire the interference protections that come with a PAL. Consistent with Nokia's initial comments, we support the Commission's exploration of a hybrid approach to support a diversity of licensees and increase investment in the band. The Commission's mention of "PEAs in urban areas and census tracts in rural areas"⁶ would address a subset of concerns raised by smaller carriers wanting access to PALs, but Nokia cautions this urban/rural distinction would fail to address large enterprise uses. Nokia anticipates CBRS applications in various enterprise use-cases, including healthcare facilities, stadiums, shipping ports and other major facilities in urban as well as rural areas. For this reason, Nokia supports a hybrid geographic license approach in all areas.

A robust secondary market would also support a diversity of deployments. Nokia urges the Commission to adopt its proposal to allow partitioning and disaggregation of PALs.⁷ Nokia recommends that all parties holding PALs take full advantage of the flexible rules regarding secondary market trading of PAL rights. Not only would this further permit a diversity of uses for smaller areas, but rights to partial PALs presumably could be for any duration of time allowing even greater diversity of use cases.

⁵ *NPRM* at ¶¶ 23-25 & Concurring Statement of Commissioner Mignon L. Clyburn.

⁶ *Id.* ¶ 25.

⁷ *Id.* ¶ 31.

Partitioning and disaggregation would allow service to targeted areas, which in turn are supported by the technical specifications being developed by the Wireless Innovation Forum (“WinnForum”) to support the development and advancement of spectrum sharing technologies based on the 3.5 GHz rules. The WinnForum has described various market mechanisms available to PAL licensees and lessees in order to take advantage of the PAL spectrum.⁸ For instance, a PAL licensee can register specific PAL Protection Areas (PPAs) within a PAL which allows the original PAL licensee to break up the service area within one PAL or within a number of contiguous PALs into smaller, “used” portions. The PAL licensee may then allow others (lessees) to coordinate and use other unused areas within the PAL by claiming new PPAs for the lessees’ own use within the same PAL. By leasing the PAL rights, other designated parties may establish these independent PPA claims associated with their own CBSD deployments.

IV. SAS ADMINISTRATORS SHOULD PROTECT CBSD REGISTRATION INFORMATION

Nokia supports the Commission’s proposal to amend the current rules to “prohibit SASs from disclosing publicly CBSD registration information that may compromise the security of critical network deployments or be considered competitively sensitive.”⁹ Nokia also agrees with the current rule for SAS administrators to exchange certain information with other SAS administrators in order to better coordinate operations of CBSDs, and supports that the proposed changes will not affect SAS-to-SAS information sharing.

⁸ Requirements for Commercial Operation in the U.S. 3550-3700 MHz Citizens Broadband Radio Service Band, Version V2.0.0, 3 February 2017, http://www.wirelessinnovation.org/assets/work_products/Specifications/winnf-15-s-0112-v2.0.0%20cbrs%20operational%20and%20functional%20requirements.pdf

⁹ NPRM at ¶ 37.

V. ALL PALS SOUGHT AT AUCTION SHOULD BE ASSIGNED, REGARDLESS OF THE NUMBER OF BIDDERS

In the NPRM, the Commission proposes to amend its rules that limit the number of PALS assigned if seven or fewer bidders seek PALS in a given area.¹⁰ The Commission further proposes it will assign PALS even when there is only one applicant in a given license area.¹¹ Applicants for PALS are seeking guaranteed spectrum with interference protection from GAA users. It would not serve the public interest to deny the benefits of a PAL to a qualified applicant – whether a carrier, industrial complex, hospital, etc. – simply because there was not enough demand by others to compete for PAL rights. The Commission’s rules currently create artificial scarcity for PALS. Instead, the Commission should amend its rules as the NPRM proposes so that all available PALS can be auctioned regardless of the number of qualified applicants.

VI. THE COMMISSION SHOULD RELAX EMISSIONS LIMITS TO FACILITATE OPERATIONS OVER WIDER CHANNEL BANDWIDTHS

Nokia supports emissions limits that would permit easier implementation of wider channels in the band than do the current emissions limits, so long as the rule change does not result in slowing down Commission authorization to commence service in the 3.5 GHz band. Nokia analyzed the current rules versus two proposals in the NPRM to determine which would best support robust operations in the band. As demonstrated below, for each of the bandwidth scenarios Nokia reviewed, the proposal submitted by Qualcomm (“Proposal 1”) is preferred over the current rules and over the more graduated proposal (“Proposal 2”).

The three options presented in the NPRM are as follows:

FCC’s Current Rules

- -13 dBm/MHz from 0 to 10 megahertz from the assigned channel edge;
- -25 dBm/MHz beyond 10 megahertz from the assigned channel edge down to 3530 megahertz and up to 3720 megahertz;

¹⁰ *Id.* ¶ 42.

¹¹ *Id.*

- -40 dBm/MHz below 3530 megahertz and above 3720 megahertz.¹²

Proposal 1 (Proposed by Qualcomm)

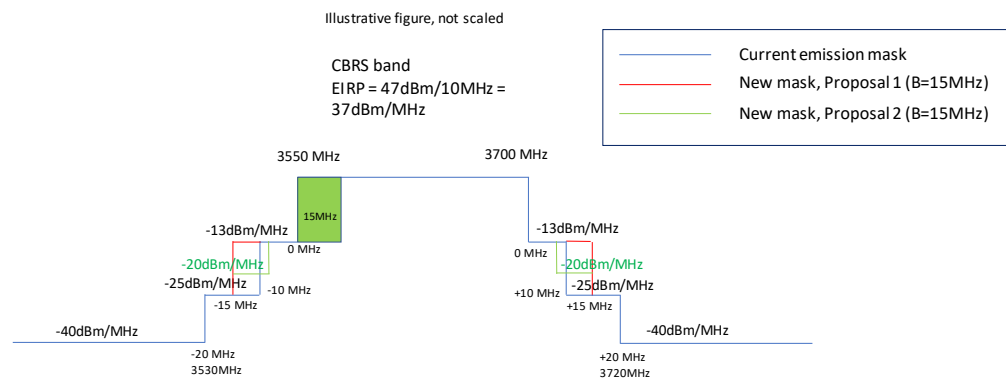
- -13 dBm/MHz limit from 0 to 100% of B;
- -25 dBm/MHz limit beyond 100% of B; and
- -40 dBm/MHz limit below 3530 megahertz and above 3720 megahertz

Proposal 2 (Qualcomm Proposal with More Graduated Reduction of Emissions Limits)

- -13 dBm/MHz from 0 to B/2 (i.e., 50% of B) megahertz from the assigned channel edge;
- -20 dBm/MHz from B/2 to B (i.e., 100% of B) megahertz from the assigned channel edge;
- -25 dBm/MHz beyond B megahertz from the assigned channel edge, down to 3530 megahertz and up to 3720 megahertz;
- -40 dBm/MHz below 3530 megahertz and above 3720 megahertz.

Below, we analyze the tradeoffs in the number and levels of the attenuation steps of the current rules and two proposed emissions masks for channel bandwidths of 15 MHz, 20 MHz, and 100 MHz.

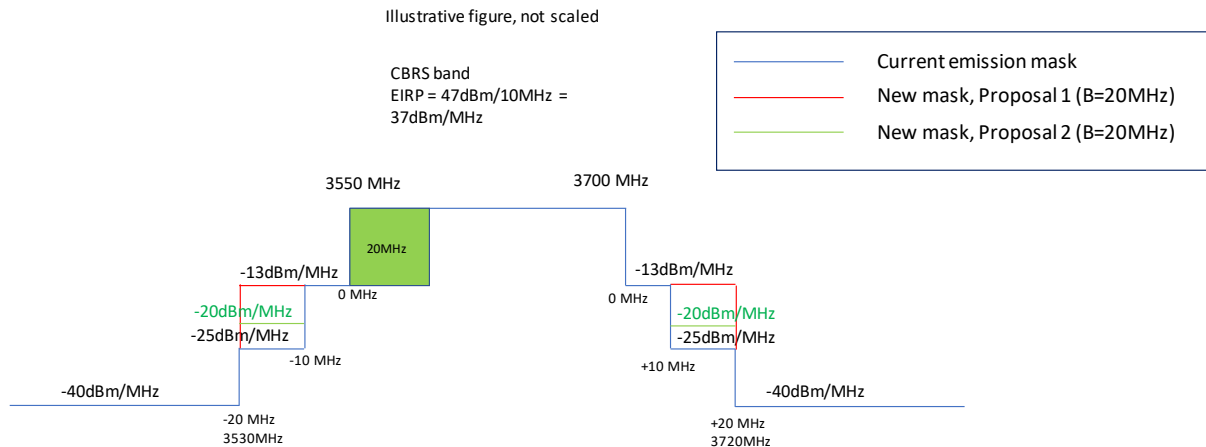
Figure 1: 15 MHz channel bandwidth



Proposal 1 is preferred for 15 MHz channel bandwidth because Proposal 2 requires tightening of the emission mask.

¹² 47 CFR § 96.41.

Figure 2: 20MHz channel bandwidth



For channel bandwidth of 20 MHz, Proposal 1 is also preferred.

Assuming a Category B CBSD and an EIRP of $47\text{dBm}/10\text{MHz} = 37\text{dBm}/1\text{MHz}$, the output power is $37\text{dBm}/1\text{MHz} - 23\text{dB}$ (antenna gain) = $14\text{dBm}/\text{MHz}$

Emission limit (current mask): $-25\text{dBm}/\text{MHz}$

⇒ 39dB Adjacent Channel Leakage Ratio (ACLR) is needed, offering a margin of $(45-39)=6\text{dB}$ with 3GPP ACLR specification of 45dB

Emission limit (proposal 1): $-13\text{dBm}/\text{MHz}$

⇒ 27 dB ACLR is needed, offering a margin of $(45-27)=18\text{dB}$ with 3GPP ACLR specification of 45dB

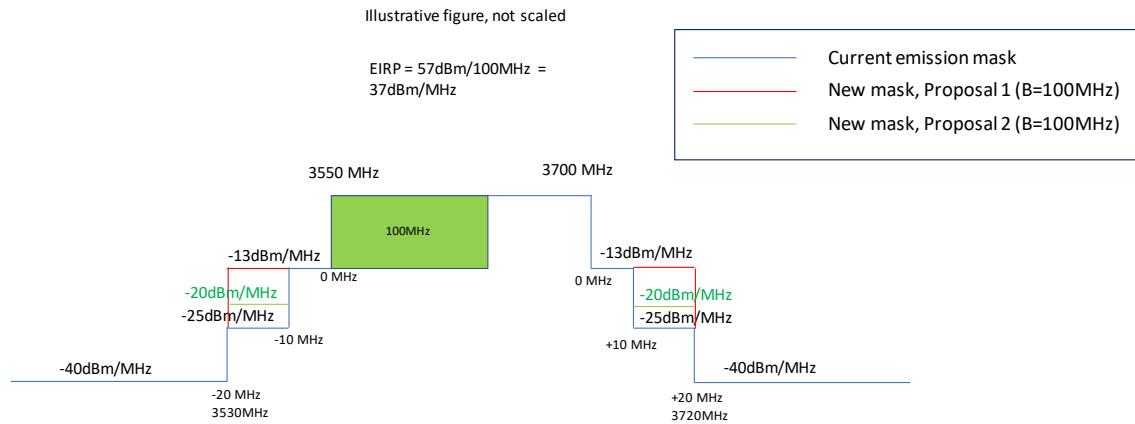
Emission limit (proposal 2): $-20\text{dBm}/\text{MHz}$

⇒ 34 dB ACLR is needed, offering a margin of $(45-34)=11\text{dB}$ with 3GPP ACLR specification of 45dB

With 20 MHz or larger channel bandwidth, the $-25\text{dBm}/\text{MHz}$ step is not valid for both Proposals 1 and Proposal 2, as 3530 MHz and 3720 MHz points are fixed.

For all three cases, the 3GPP ACLR specification of 45dB is met with the assumed output power. However, Proposal 1 is more relaxed compared to Proposal 2 and offers more margin with the 3GPP ACLR specification.

Figure 3: 100 MHz channel bandwidth



For the 100 MHz channel bandwidth example, as well, Proposal 1 is preferred. The fixed points 3530 MHz and 3720 MHz set the limits for filtering. To meet -40dBm/MHz at 3530 MHz and 3720 MHz, the required attenuation is $14+40 = 54$ dB. Assuming an ACLR of 45dB, this means that an additional attenuation of 9dB via filtering is potentially needed to meet the FCC limit.

The same ACLR analysis as for the 20MHz channel bandwidth above applies to the 100 MHz channel bandwidth case. As power is scaled according to bandwidth, ACLR requirements for 100 MHz channel bandwidth remain the same as for 20 MHz channel bandwidth. Proposal 1 is more relaxed compared to Proposal 2.

Large bandwidth signals are challenging from an implementation point of view in general. Relaxed emission mask eases Power Amplifier (PA) requirements and allows a reasonable compromise between PA and filter performance requirements.

In sum, Proposal 1 is preferred because it enables reasonable requirements for PA implementation and ease of testing due to the smaller number of emission mask steps. While there may be some margin built into product implementation with respect to regulatory or 3GPP emissions limits due to cost but also to fulfill requirements in extreme conditions, it is

incorrect to assume that actual out-of-channel emissions in the 3.5 GHz Band will be substantially lower than these limits. There is always a trade-off between cost and performance. For instance, temperature drift compensation for filter is likely needed in all cases due to the -40dBm/MHz requirement below 3530 MHz and above 3720 MHz when assuming high output power like 14dBm/1 MHz, which leads to significant cost increase compared to a non-compensated implementation.

VII. CONCLUSION

For the foregoing reasons, Nokia urges that the Commission revise its rules consistent with these Comments.

Respectfully submitted,

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